



NYSERDA

**Energy Efficient Indoor Air Quality (IAQ) Studies
Preliminary Monthly Reports Summary
for July 2020**



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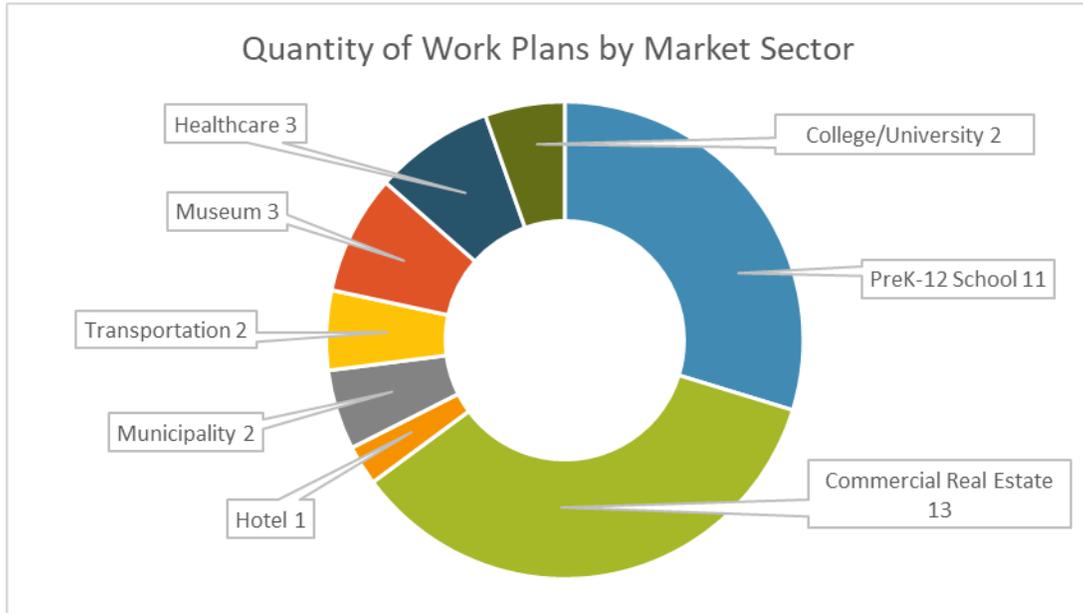
1.0 Introduction

This report is intended to summarize the monthly reports submitted in July by the FlexTech consultants whom have been tasked with evaluating energy efficient COVID-safe building upgrades and operational adjustments for customers who are seeking recommendations for re-occupying their spaces safely while maintaining the pursuit of energy efficiency. The following sections will present each consultants' project progress, IAQ solutions considered in the projects, and a summary of conclusions, key findings, and commonalities found across all projects.

The consultants discussed in this report are presented in the table below, along with the enrolled customers and the regional location and market sectors of the buildings chosen to participate in the study.

Consultant Conducting Study	Customer	Regional Building Location	Market Sector
AKF Engineers, LLP	Tishman Speyer	New York City	Commercial Real Estate
	Commercial Office Building	New York City	Commercial Real Estate
Bergmann Associates	The Harley School	Finger Lakes	PreK-12 School
	St. John Fisher College	Finger Lakes	College/University
Edison Energy, LLC	Memorial Sloan Kettering Cancer Center – Breast & Imaging Center	New York City	Healthcare
	Memorial Sloan Kettering Cancer Center – Josie Robertson Surgery Center	New York City	Healthcare
EMCOR Services Betlem	Rochester Museum and Science Center	Finger Lakes	Museum
	Finger Lakes Community College	Finger Lakes	College/University
Goldman Copeland Associates, P.C.	Large Midtown Manhattan Commercial Office Building #1	New York City	Commercial Real Estate
	Large Midtown Manhattan Commercial Office Building #2	New York City	Commercial Real Estate
	Large Midtown Manhattan Commercial Office Building #3	New York City	Commercial Real Estate
Guth DeConzo Consulting Engineers, P.C.	Albany Medical Center	Capital Region	Healthcare
	North Colonie Central School District	Capital Region	PreK-12 School

Consultant Conducting Study	Customer	Regional Building Location	Market Sector
Jaros, Baum & Bolles Consulting Engineers, LLP (JB&B)	Museum of Modern Art – Main Campus	New York City	Museum
	Museum of Modern Art – Queens Campus	New York City	Museum
	Rudin Management Company – 80 Pine	New York City	Commercial Real Estate
	Rudin Management Company – 3 Times Square	New York City	Commercial Real Estate
	Rudin Management Company – 345 Park	New York City	Commercial Real Estate
	New Water Street Corporation	New York City	Commercial Real Estate
	Horace Mann School – Aquatics Center	New York City	PreK-12 School
	Horace Mann School - Pforzheimer Hal	New York City	PreK-12 School
	Horace Mann School – Science Center	New York City	PreK-12 School
	Horace Mann School - Tillinghast Hall	New York City	PreK-12 School
LaBella Associates, D.P.C.	Niagara Frontier Transportation Authority – Buffalo Niagara International Airport	Western New York	Transportation
	Niagara Frontier Transportation Authority – Metro Transportation Center	Western New York	Transportation
	City of Rochester – Blue Cross Arena	Finger Lakes	Municipality
	City of Rochester – Rundel Public Library	Finger Lakes	Municipality
	Rosenblum Companies	Capital Region	Commercial Real Estate
	Webster Central School District – Dewitt Elementary	Finger Lakes	PreK-12 School
	299 Old Niskayuna Road, LLC	Capital Region	Commercial Real Estate
	North Tonawanda School District – Intermediate School	Western New York	PreK-12 School
Syska Hennessy Group	Manhattan Commercial Office Tenant	New York City	Commercial Real Estate
	Westchester Commercial Office Facility	New York City	Commercial Real Estate
Vidaris, Inc.	Mark Hotel	New York City	Hotel
	Tishman Speyer	New York City	Commercial Real Estate
Wendel Energy Services, LLC	School District	Western New York	PreK-12 School
	Williamsville Central School District	Western New York	PreK-12 School



2.0 Consultant Progress Overview

The following table summarizes the progress made by each of the consultants on their work plans (i.e. the defined study scope). Typically, each work plan represents one building study, however in some cases there are multiple buildings represented in a work plan.

For each milestone listed below, the number of work plans that have completed a milestone are indicated.

Consultant	# of Work Plans	# of Buildings Represented	Data Collection Completed (# of Work Plans)	Onsite Work Completed (# of Work Plans)	Analysis of Proposed Solutions Completed (# of Work Plans)	Study Report Completed (# of Work Plans)	Expected Report Completion Dates
AKF	2	2	0	0	0	0	Mid-November
Bergmann	2	13	1	1	0	0	Mid-September – Late December
Edison Energy	2	2	2	0	0	0	Late September – Early December
EMCOR	2	3	0	1	0	0	Late October
Goldman Copeland	3	3	3	0	0	0	Late August
Guth DeConzo	2	7	0	0	0	0	Mid November
JB&B	10	10	0	0	0	0	Late August
LaBella	8	8	0	0	0	0	Early November
Syska Hennessy	2	2	1	0	0	0	Mid-November
Vidaris	2	2	0	1	0	0	Late September
Wendel	2	8	0	0	0	0	Mid-December
Total	37	60	7	3	0	0	Last Report: Late December

3.0 Solutions Considered

Each consultant is evaluating a series of solutions intended to make each building COVID-safe while limiting the impacts on building energy efficiency. These solutions are intended to be implemented so that the buildings can run efficiently without sacrificing safe IAQ. Solutions being explored by the consultants are described below:

Ventilation

Improved ventilation strategies are intended to remove contaminated air from occupant spaces and provide fresh outdoor air to occupant spaces such that safe IAQ can be achieved while optimizing energy use and meeting code minimums. Ventilation options under consideration include:

- Increased outdoor airflow
 - Greater amounts of fresh outdoor air are supplied to the space, decreasing the concentration of contaminated air
- Reduced outdoor airflow
 - Some spaces provide greater outdoor airflows than is necessary to maintain safe IAQ. Outdoor airflows can be reduced to maintain safe IAQ and code minimums while reducing energy use
- Negative space pressurization
 - Air is exhausted from individual rooms at a greater rate than it is supplied, limiting the spread of contaminated air from room to room within the occupant space

Filtration

Improving filtration limits the size and amount of harmful particulates entering the occupant space. Filtration options under consideration include:

- MERV 13 or greater filters
 - MERV (Minimum Efficiency Reporting Value) filters are rated by the minimum particulate size a filter can capture. Higher MERV values correspond to lower minimum particulate sizes. MERV filters rated at 13 and above capture smaller particulate sizes than standard commercial MERV 8 filters.
- HEPA filters
 - HEPA (High Efficiency Particulate Air) filters capture smaller and more numerous particulates than MERV 13 or greater filters
- Adding a prefilter
 - Lower MERV rated prefilters located upstream of a higher MERV rated filter will capture larger particulate matter so the higher MERV rated filters downstream will not get clogged as quickly
- Electrostatic filters
 - The filter media contains an electrostatic charge which enables a greater attraction of particulate matter to the filter

HVAC Controls Improvements

Improving the operation of HVAC controls systems allows for automated, reliable responses to changes in IAQ demands while limiting the amount of building energy use. Controls improvements under consideration include:

- Time of day scheduling
 - Air handling units are operated based on occupancy schedules, so that they use the most energy to ventilate a space when it is occupied and save energy when a space is unoccupied
- Demand controlled ventilation
 - Air handling units increase or decrease ventilation rates based on sensed occupancy of a space
- Airflow setbacks
 - Variable air volume (VAV) units limit the amount of airflow provided to a space when it is unoccupied, based on either sensed occupancy or a pre-programmed schedule
- Airside economizer sequence
 - Outdoor airflow is increased beyond its minimum safe level when doing so would result in decreased energy use (used for cooling and typically based on outdoor air temperature).

UVGI

Ultraviolet germicidal irradiation (UVGI) technologies are intended to inactivate virus particles and kill microbes by applying an ultraviolet light to a surface or airstream. UVGI systems being evaluated include:

- In Duct
 - UV source located within ductwork
- In AHU
 - UV source located within air handling unit (at filter or coil)
- Upper Room
 - UV source located in the upper (typically above 8 feet) part of a room
 - avoids UV contact with occupants, allowing the system to be in use during occupied hours
- Whole Room
 - UV source located within occupant's level
 - UV light contacts occupant spaces, restricting operation to unoccupied hours
- Portable
 - Portable UV source located within occupant's level
 - UV light contacts occupant spaces, restricting operation to unoccupied hours if portable UV light is at full power.
- Elevator
 - UV source located in elevator car
 - activated when elevator car is not occupied

Other Solutions

Other solutions considered include the following:

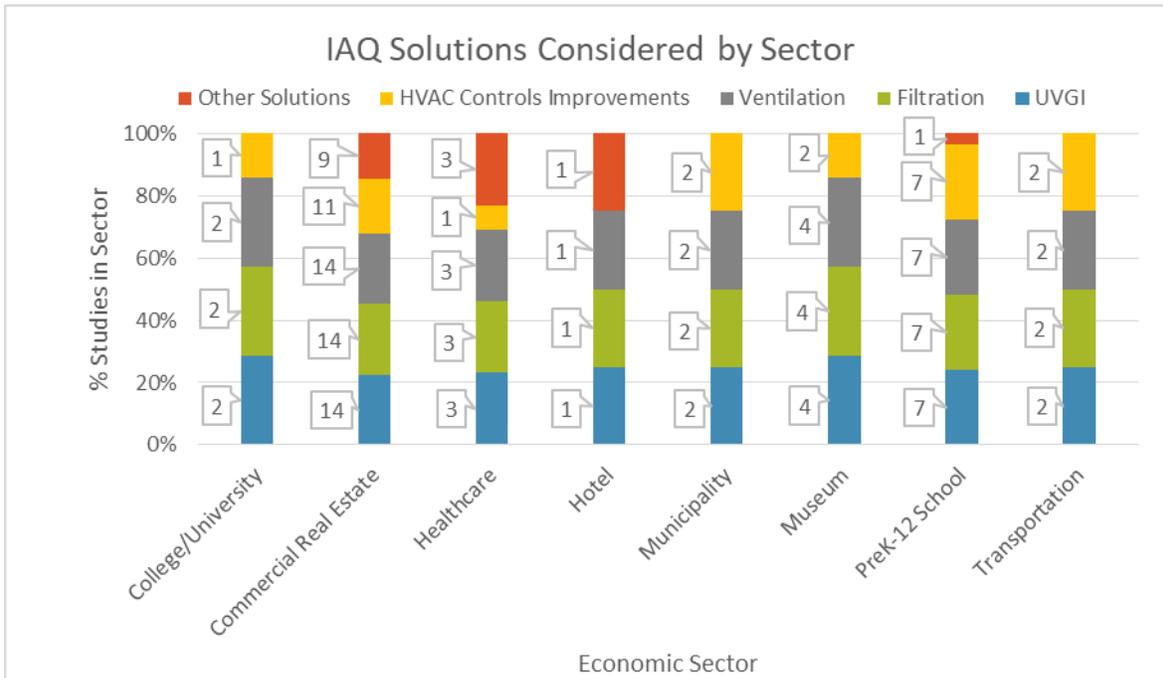
- Energy or heat recovery
 - Heat taken from exhaust air is transferred to incoming outdoor air in order to limit the additional heat energy needed to condition greater amounts of outdoor air.

- Air sealing
 - Individual rooms are made air-tight in order to limit the spread of contaminated air from room to room
- Retro-commissioning
 - Existing systems are tested, inspected, and repaired or replaced to ensure they are operating optimally
- Bi-polar ionization (not included as part of the NYSERDA-funded study)
 - Reactive ions are introduced into the airstream in order to neutralize bacteria, viruses, and other particles.
 - Effectiveness of this technology is not widely verified and has therefore been excluded from the NYSERDA-funded scope of these studies until independent, unbiased, 3rd party evidence of the technology's ability to inactivate the SARS-CoV-2 virus and operate safely becomes available.

3.1 Prevalence of Solutions Considered by Sector

The number and percentage of studies for which each solution is being considered within each market sector is presented in the graph below. Note that in the instance where work plans contain more than one building, each building is represented as an independent study in the graph below.

Note that solutions covered under the “Other Solutions” category may be broken out into their own categories in future reports if there is an apparent widespread evaluation of any of these specific solutions across multiple work plans.



4.0 Issues Encountered and Common Observations

A summary of relevant issues encountered and observations that have been identified are presented below, categorized by market sector.

College and University – 2 work plans

- The AHUs in one (1) work plan are old and due for replacement. This makes UVGI application in these units unfeasible as a long-term solution.

Commercial Real Estate – 14 work plans

- Although AHUs are reported to exist in twelve (12) of the studies, only ten (10) of the studies are considering in-AHU UVGI and only five (5) are considering in-duct UVGI.
 - The AHUs in one (1) study are too large of a size for practical application of in-AHU UVGI.
 - The site conditions in one (1) study limit adequate access for installation of in-duct UVGI.
 - Two (2) studies did not report on the existence of AHUs, yet still indicate that they are considering in-AHU UVGI applications.
- Eight (8) studies are considering upper room UVGI.
- The only study considering air sealing to date is in this sector.
- The only two (2) studies considering retro-commissioning measures to date are in this sector.
- Two (2) studies are considering bi-polar ionization and other solutions that are outside the NYSERDA-funded portion of this study.

Healthcare - 3 work plans

- Although AHUs are reported to exist in three (3) of the studies, no studies are considering in-duct UVGI and only one (1) study is considering in-AHU UVGI.
 - The two (2) studies that did not specify considering in-duct nor in-AHU UVGI indicated that UVGI would be considered generally, but did not indicate what specific type of UVGI would be considered.
- Two (2) studies are considering upper room UVGI.
- Two (2) studies are considering energy recovery.
- One (1) study is considering bi-polar ionization and other solutions that are outside the NYSERDA-funded portion of this study.

Hotel – 1 work plan

- The site conditions in this study limits adequate access for installation of in-duct UVGI.

Municipality – 2 work plans

- The design characteristics of the AHUs in one (1) study cannot accommodate the installation of improved filters nor in-unit UVGI.
- Both studies in this sector are considering in-AHU UVGI.

- Both studies in this sector are considering in-AHU HEPA filters.

Museum – 3 work plans

- The only two (2) studies considering portable HEPA filters to date are in this sector.

Pre-K – 12 Schools – 11 work plans

- For buildings that contain air handlers (6 work plans), in-AHU UVGI is only being considered for four (4) work plans.
- Only one (1) work plan in this sector is considering upper room UVGI and one (1) other work plan is considering whole room UVGI.
- One (1) study is considering bi-polar ionization and other solutions that are outside the NYSERDA-funded portion of this study.

Transportation – 2 work plans

- The design characteristics of the AHUs in one (1) study cannot accommodate the installation of improved filters nor in-AHU UVGI.

Overarching

- One (1) study in the College/University sector and one (1) study in the Commercial Real Estate sector have existing in-AHU and/or in-duct UVGI systems installed.
- One (1) study in the College/University sector and one (1) study in the Commercial Real Estate sector have existing MERV 13+ filters installed.

5.0 Consultant Study Sources

The sources used by the consultants for these studies are cited below:

1. ASHRAE Epidemic Task Force (last updated 6/17/2020),
<https://www.ashrae.org/technical-resources/resources>
2. ASHRAE Standard 62.1-2013, Ventilation for Acceptable Indoor Air Quality
https://ashrae.iwrapper.com/ASHRAE_PREVIEW_ONLY_STANDARDS/STD_62.1_2019
3. ASHRAE Standard 211-2018, Standard for Commercial Building Energy Audits
https://ashrae.iwrapper.com/ASHRAE_PREVIEW_ONLY_STANDARDS/STD_211_2018
4. Renat Manassypov, *Evaluating Virus Containment Efficiency of Air-Handling Systems*, ASHRAE Journal, July 2020
5. Zhen-Dong Guo et. al. *Aerosol and Surface Distribution of Severe Acute Respiratory Syndrome Coronavirus 2 in Hospital Wards, Wuhan, China, 2020*, CDC EID Journal Volume 26, Number – July 2020
6. Mahesh Jayaweera et. al. *Transmission of COVID-19 virus by droplets and aerosols: A critical review on the unresolved dichotomy*, NIH's Elsevier Public Health Emergency Collection, June 13, 2020
7. Emanuel Goldman, *Exaggerated risk of transmission of COVID-19 by fomites*, The Lancet, July 30, 2020
8. Steven Taylor, Taylor Engineering, *Covid Transmission White Paper*,
<https://taylorengeers.com/wp-content/uploads/2020/05/TE-COVID19-White-Paper.pdf>
9. Mosto Technologies, Humidification White Paper
10. Steril Aire, Equipment Information and Specifications